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Smithsonian Institution

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Telephone Without Wires a Success

Prof. Collins Sending the First Message from one Ferryboat to Another in the North River, New York.

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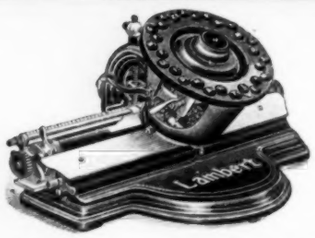

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Mention Popular Mechanics.

A NEW ROMANCE OF STEEL.

Twenty-three Years of Experiment Yields Results.—Steel in Forty Minutes

For twenty-three years Frank Johnson, of Duluth, Minn., has been studying and experimenting with the very refractory iron ore known as "Titanic." Great quantities of this ore are found in Cook county, Minnesota, and in other parts of the state, but no practical use has been made of it on account of the difficulty experienced in smelting. Mr. Johnson thinks, however, that he has the correct method, and press dispatches credit him with a successful experiment before 250 capitalists and mining engineers at St. Paul, in the Valley Iron Works. The ore had been brought to St. Paul, where it was fluxed with lime and heated in an ordinary cupola with coke; when the cupola was tapped the product ran clear and white—a superb article of steel in 40 minutes. It was immediately decided to build a $100,000 smelter at Duluth with a capacity of 200 tons a day. The friends of the project look for the new product to revolutionize the iron industry as the product of titanium is said to excell the best Swedish steel. The supply of ore is practically inexhaustible.

TELEPHONING THROUGH SPACE.

Remarkable and Successful Test on North River

Tests recently made by A. Frederick Collins, in the North River, New York, almost in the same waters where nearly one hundred years ago Robert Fulton proved his steamboat to be a success, showed that the wireless telephone is perfectly practicable for commercial use. The tests were made from two moving ferryboats going in opposite directions with the vessels several hundred feet apart. The apparatus used was very simple. It consisted of wires attached to the top of the flagstaff of the boat, a wire running from the receiver and transmitter in the pilot house and connecting with a copper plate held under water, and ordinary electric batteries. The 'phone was just like the one in common use, with a bell for ringing up and microphones for talking and listening.

The only means of communication between the boats was through the water and the air. All the scientists present were convinced of the success of the test. The words of Prof. Collins were distinctly heard by his brother in the other boat and there was an absence of the scratchy sound heard in the ordinary telephone. On account of the crude apparatus used and the moving about of the submerged copper plates by the waves, the messages were not as distinct as they can be made. This part of the apparatus will be developed into more perfect form, overcoming this difficulty.

Prof. Collins is of the opinion that his invention will prove of the greatest service at a distance of one thousand or two thousand feet. It will be put to immediate use to warn vessels of their approach to each other in a dense fog.

While wireless telephony is not new it remained for Prof. Collins to show that it may be adapted to commercial use.

ELECTRIC LIFE-SAVING HOOK.

J. McKenna, a Scotchman, has invented an electric life-saving hook by means of which searching for bodies at night is made comparatively easy. The apparatus consists of the usual long pole with a hook, but in addition an electric light is attached at the outer end. When search is being made for a body in the water at night the electric light is made to glow and all objects in the path of the rays are rendered distinct. Current may be taken from electric light wires if near by, or from a portable storage battery.

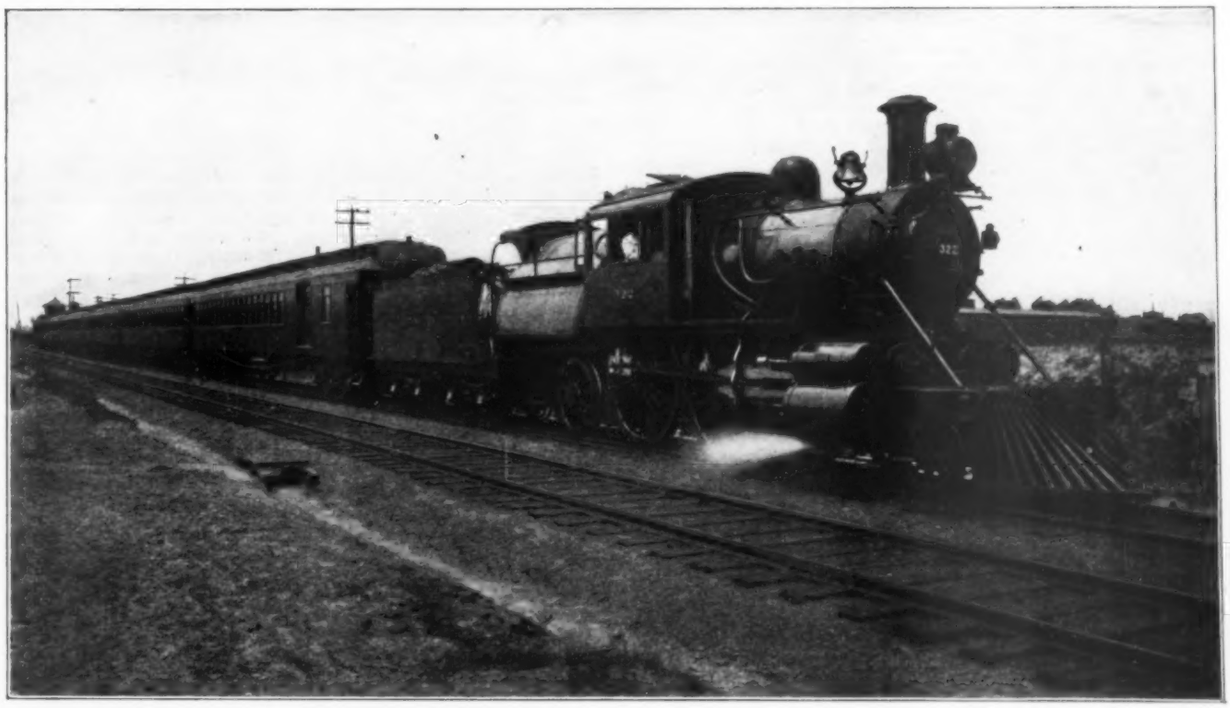
PRESERVING COAL IN SEA WATER.

Submarine coaling depots at big steamship coaling stations are possibilities of the future. Recently experiments with a view to preserving the calorific properties of hard coal by immersion in salt water were made, and it was demonstrated that a loss of but one per cent occurred. Stored in the ordinary way coal loses about 50 per cent of its calorific power. There are difficulties, however, in this method of storing coal, and The Marine Engineer of London raises these puzzling questions: Whether to conduct the storage on shore in a tank or well, or afloat by sinking a lighter full of coal; also whether wetted coal is considered dangerous for issue to ships; and is it considered that coal so immersed would require to be dried before issue; and, if so, how it is proposed to do this if large quantities of coal are stored under water before issue; and whether an opinion can be furnished as to the respective merits of coal stored under cover and under water. Rain-sodden coal is said to cause bunker fires, but the effects of coal soaked in sea water yet remains to be seen.

FOOTWEAR FOR DOGS.

There are people who are more interested in dogs than children, and to supply their demand there is a store in New York where footwear for dogs is a feature. In large showcases are arranged the various kinds of rubbers and calf and tan shoes. In France valuable or pet dogs are always made to wear rubbers and rubber blankets when taken out on a wet day. A set of four leather boots for a dog costs from $4 to $10, while two pair of rubbers can be had for $2 to $3. In many cases the boots are made to order, the measure being taken by drawing the shape on a piece of paper on which the dog stands. The boots are always laced; the rubbers are held in place by their own elasticity.

Edison has taken out 800 American patents, on which the official fees were $51,000.



Instantaneous Photo of Train Under Full Speed

The illustration above is from an instantaneous photograph of a moving train on the Atlantic City Railroad, drawn by a Baldwin locomotive of the Atlantic type. The position of the engineer is seen to be midway on the locomotive. These trains hold the world's record for sustained speed, having for a number of years, made daily runs between Camden and Atlantic City for the summer seasons at a speed averaging over 70 miles an hour.

NO BURYING ALIVE.

Not a few people have a mortal fear of being buried alive, but however frequent such a thing may have been years ago, there is little danger in the hands of the modern undertaker. The Western Undertaker quotes a leading member of the profession who says: "We have severe tests. The appearance of the dead is usually convincing. Or we can raise a little blister on the skin with a burning match. If the subject is still living, that will make a water blister; otherwise the result will be a dry air blister. But if we decide to go on with the embalming, the very first incision, usually in the arm, will afford satisfactory proof of death. Should the least bit of blood flow, we would understand that some circulation was still taking place, that the subject was not quite dead.

"But as a mater of fact, there's only one absolutely certain sign of death—decomposition. Before decay sets in any of the best-known signs may at very rare intervals prove deceitful. Over in Germany a big reward has been offered for years to anybody that would establish some sign of death that would invariably prove reliable. The reward has never been paid.

"That isn't so important, though, as it looks, because undertakers of any experience see many evidences of death as soon as they take up a subject. We don't have to depend on any single sign. So if one indication proved misleading we would have the other signs to set us right. The combination of evidence I feel sure, would never be present in case the subject was still living.

"Yes, there is no such thing as being buried alive, if you've been embalmed, and nine-tenths of all bodies are embalmed nowadays."

CALIFORNIA A GREAT SHIPBUILDING STATE.

It may not be very generally known, but it is nevertheless a fact, that California stands in the front rank as a shipbuilding state.

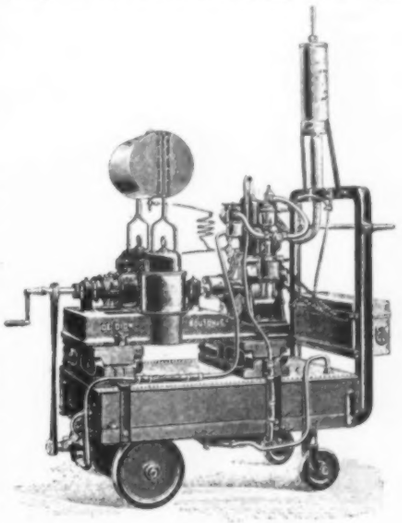
During 1902 there were 42 vessels exclusive of war ships built on the shores of San Francisco and San Pablo bays. This total was equally divided between steam and sail craft.

The gross tonnage was 26,226 tons and the net figures were 20,095 tons. On the north and south coasts of California a number of other vessels were built mostly for the coastwise trade.

California stands third in value of new vessels among the shipbuilding states, Pennsylvania being first and New York second.

PORTABLE GAS ENGINE-ELECTRIC PLANT.

A French firm have built a novel combination of gas engine and dynamo which can be easily moved about. An electric regulator reduces the supply of gasoline according to the load. This makes it specially available for driving small motors and machines. It may also be used for electric lighting. The regulator consists of a solenoid with movable core, which rises or lowers with the



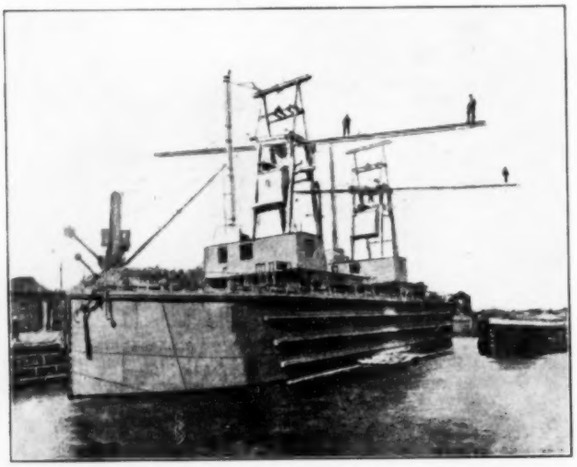
Portable Electric Plant

load. The engine is water cooled from the tank placed above the dynamo. The water circulates by gravity.

The Strait of Canso, between Cape Breton and the mainland of Nova Scotia, is to be bridged. The task is an immense one, involving great engineering difficulties and the outlay of about $5,000,000. The bridge will be a cantilever, with a span of 1,800 feet, which makes it the longest in the world.

A FLOATING COAL MINE.

The accompanying illustration from the Shipping World, London, shows a Temperley Coal "Haulabout" of 1,000 tons capacity taking in coal at Portsmouth dockyard. The hulls of these "haulabouts" are plain steel barges with hatchways extending nearly across the vessel. Each vessel is equipped with two self-contained Temperley traveling tower trans-



A Floating Coal Mine

porters, the beams of which have a very long overreach on either side and are high enough to take coal from a large collier and deliver it direct on to the boat deck of the largest battleships or cruisers. As the towers are made to travel the full length of the vessel they command the whole of the hold, both for filling and discharging purposes. Each tower is fitted with a steam boiler and special engine for hoisting and conveying the load, for raising and lowering the overhanging parts of the beams, and for propelling the tower along the rails. This engine is also fitted with gearing and lifting tackle for removing and replacing the hatch covers, which are picked up and carried to the end of the vessel by traveling the towers along in the usual way. The principal purposes for which these craft have been built are to provide a coaling vessel of considerable storage capacity, capable of being hauled about from vessel to vessel, where it can either supply coal from its own hold or be used for discharging coal direct from the collier to the vessel to be coaled. The vessels have to be capable of filling their own holds either from colliers or from the shore, for which purpose they are supplied with automatic dumping buckets.

WHERE THE TIN CANS GO.

What May be Done with Discarded Cans

The succulent tin can is taken from the hungry goat and turned to the relief of human needs by a New York manufacturer. Having robbed the goat and the Weary Willie of his tin cans from the city dumps the cold and calculating economist orders them piled upon a large iron grating, located under a sheet-iron hood which terminates in a smokestack. They are sprinkled liberally with crude oil which is set on fire. This process consumes the labels, loosens the dirt and melts the solder, which falls through the grating, is collected, washed and melted, cast into ingots and sold to be used again, says a correspondent to the American Machinist.

Some of the cans, which have simply lapped and soldered joints, melt apart completely; these are sorted out and the sheets forming the shell are straightened and bound into bundles to be sold to trunk makers, who utilize them for protecting the corners of Saratoga trunks. They are also bought by button manufacturers, who stamp from them the disks used in cloth-covered buttons.

The remainder of the cans are dumped into the cupola. The cupola is fed with coke and cans in alternation. There is occasionally an old wash-boiler or a bundle of tin roofing used, but cans form the bulk of the material. The cans are so light that some of them are carried out at the top of the stack by the force of the blast, and a large screen has been arranged to prevent the pieces from falling on the roof.

The product of the cupola is turned into sash weights, elevator weights and ballast for boats.

IRRIGATING WELLS IN MONTANA.

Montana does not require the irrigation that many western states must have, but such lands as need water are remarkably productive when supplied with it. There are many flowing artesian wells in the state. The illustration shows one of the group of seven wells in Teton county flowing pure sweet water in great abundance, which is gathered in reservoirs.

The report of the State Department of Agriculture says: Many a reservoir is of little use on account of the large seepage loss from the bottom and sides. The seepage from the bottom may be almost wholly prevented by puddling. When the reservoir is small and used in part for a domestic supply, it frequently pays to haul pulverized clay and spread it over the bottom and for some distance up the sides. It is then moistened and rammed. A layer of gravel spread over the moistened clay and rammed flush with the surface is very effective.

One of the Flowing Irrigation Wells, Montana

If the stored water is only used for irrigating, the new reservoir may be made a feeding ground for sheep. A very thin layer of clay, when moistened and well packed into the natural soil by the feet of sheep will make a lining that is nearly water tight.

HOW FLIES SPREAD TYPHOID.

A ship sails with all on board well and happy and enters the next port two or three weeks later with yellow fever on board. How it came has been a mystery in many cases, but it now is pretty well established that mosquitoes bring it on board and sting the poison into the sleeping passengers.

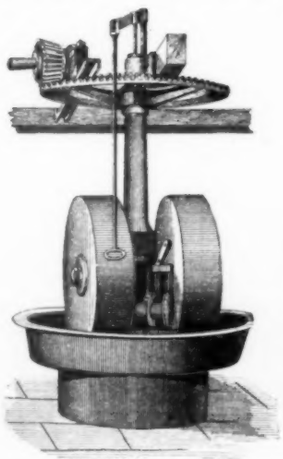
European scientists have recently completed a series of long and careful experiments which throw new light on the work of the house fly and the remarkable vitality of the typhoid germ. A vault was cleaned, the contents thrown upon the ground, where they remained for fifteen days during freezing weather. After all this experimenters succeeded in cultivating from the garden soil true typhoid baccili. Observations prove that the contents of vaults containing typhoid baccili may continue dangerous for months.

The Journal of the American Medical Association states that the experiments showed flies fed with typhoid baccili were able to convey the microbes to objects with which they may come in contact for as long as twenty-three days after feeding.

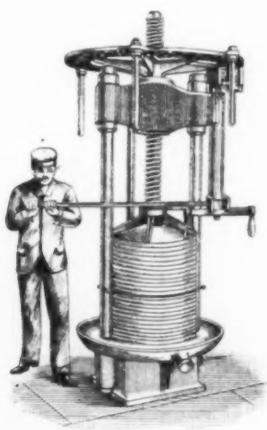
"The independent investigations of these several authors will certainly tend to increase the suspicion with which the wanderings of the house fly are coming to be regarded. The protracted vitality of the typhoid bacillus in privy vaults, the long period during which the fly itself is capable of disseminating infection and the rapidly accumulating epidemiologic evidence all point to the importance of a source of infection, the very existence of which has until lately been insufficiently recognized."

MAKING OLIVE OIL IN FRANCE.

The best olive oil is obtained from fruit which has not fully ripened, which, in France is during the first two weeks in October. The olives are picked by hand for preserving, but are shaken upon sheets placed on the ground when used for the oil alone. They must be taken to the mill at once, where they are placed in crushers and ground with heavy



Crusher



Hand Press

stone wheels. The pulp is next spread upon "scourtins" or mats which are built up until a press is filled. When oil will no longer flow from the press the scourtins are removed, the pulp broken up, softened with water and once more put through the press. This process is repeated several times until it is no longer possible to secure more. The oil is then placed in stone jars to settle and clarify, when it is ready to bottle.

RAILROAD FOR GALILEE.

The Turkish government has obtained the English concession to build a line of railroad from Haifa to Damascus. A line will also be built through Galilee to Mzerib via Beisan, connecting at Mzerib with the Damascus-Mecca line. The road from Haifa to Mzerib via Besian will be a narrow-gauge line, 40 inches in width, and will cost $2,000,000. While it is being built for strategetical purposes it will develop a large territory. The Damascus-Mecca line has now reached a point east of the Dead Sea.

A TRAINING SCHOOL FOR NAVAL STOKERS.

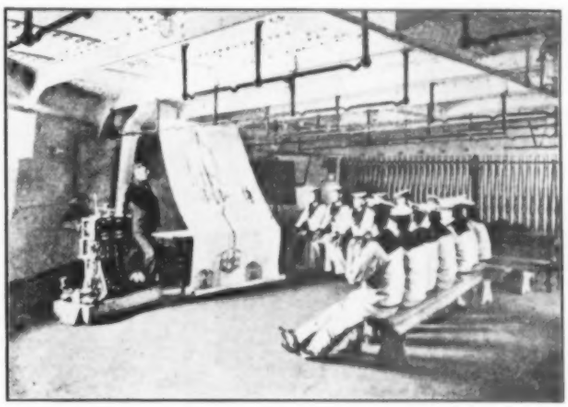
How the British Navy Keeps up to its Supply of Firemen Who Man the Boilers

All present day industry demands more and more men who use their brains as much as their hands. The laborer must become more intelligent to handle modern machinery. This gives the laborer greater honor and he knows it. So the lower deck men on the man-of-war sing:

"Captain on the bridge above, thinks he runs the show,
'Tain't him, it's the stoker, as makes a warship go.
The blimy, grimy stoker, lugging at the skids,
An' only gettin' shillin's where the captain he gets quids."

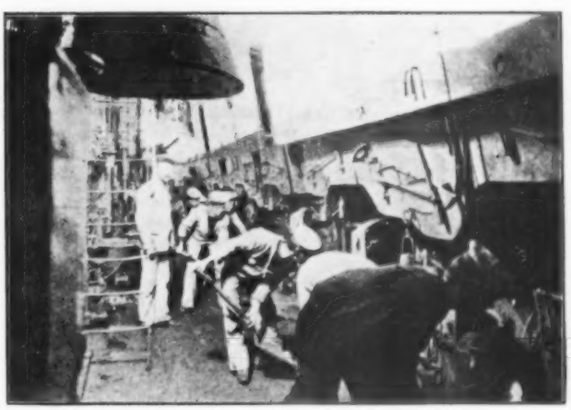
To keep up a supply of intelligent stokers the British naval authorities have detailed the old warship Nelson to act as a school room for prospective coal handlers.

The men are divided into classes, says the Engineering



Teaching Theory

Times, just as in any other school. The stoker is taught the parts of the engine so that he may take charge of some of the small engines which have hoisting duties and similar work on a big ship. He is instructed in lubrication, looking after drains and in firing the big boilers. His shovel practice is with stones and sand at first so that he may learn to use his shovel with either hand and become used to working in a confined space without wasting real fuel. In another class he is taught to make packing, lag steam pipes, trim lamps, tie knots and sling heavy weights. He is apprenticed in brick laying for boiler setting and can build a brick bridge for a furnace by the time he is graduated. His final course is in handling the water tube boiler and for this he is familiarized not only with feeding and firing but with all the mechanism of a boiler and the value of fuels. Many times men show special aptitude for mechanical work and are rapidly advanced to the positions of stoker mechanic with increased pay.



Practice in Stoke Hold

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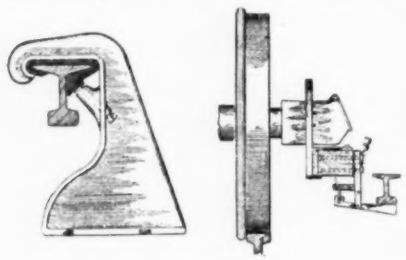
INVERTED SAFETY THIRD RAIL FOR ELECTRIC RAILWAYS.

There has been devised a special type of underrunning third rail for use on the Aurora, Elgin & Chicago Railroad which will do away with all trouble from sleet and be a safeguard against danger from shock. The illustration shows the inverted rail and its support, between which is placed the insulating material. The contact shoe, as shown, is supported from the car through suitable insulation and by means of a double acting metallic spring placed between the shoe and the support is in constant electrical contact with them and holds the shoe firmly in a normal position. To the support is secured the electrical conductor to the motor on the car. From the standpoint of safety alone this type



Safety Third Rail

of third rail will claim the attention of surface roads now using the old exposed rail, and marks an important improvement. Third rail surface roads will certainly have to adopt something of this kind soon. It is the invention of Leonard Wheeler, an expert railway electrician.

WHEN A BOY EATS ICE.

The Engineer figures out the following thermo-dynamical problem, showing what happens when a boy eats an icicle:

"A boy eats two ounces of ice. Let us see what is the approximately thermo-dynamic equivalent of the work he has made his interior do, assuming he takes five minutes to eat it. In melting the ice he will require 18 units to reduce it to water. To raise it in temperature to that of his inside he will require seven more units, or a total of 25 British thermal units. Taking the mechanical equivalent as 777 foot pounds, this will be equal to 19,425 foot pounds. If the boy weighs 100 pounds he will have called upon his stomach to do as much heat work as would, with a machine having unit efficiency, raise him 194 feet, or a rate of heat extraction equal to an eighth of a horse power."

A SIMPLE MOLE-KILLER.

In many sections of the country moles are a regular pest. A correspondent in the Kansas Farmer describes a simple way of killing them:

"Up to five years ago I was very much annoyed by moles working in my vegetable garden. All efforts to stop their burrowing proved unavailing, until I tried bi-sulphide of carbon. I filled an ordinary sewing machine oiler with the liquid, made a small hole near the level ground into the burrow with a lead pencil, injected the poison into the burrow through the opening and then closed the opening by covering up with a little loose dirt. From that day till now I have not seen any of their work in my garden. This remedy is easy of application, costs only about five minutes of time and one cent's worth of bi-sulphide."

SIZE OF MAILING CARDS.

A new ruling of the postoffice department removes many of the limitations formerly placed upon the private mailing card. Under the new regulations any card of the weight of the ordinary postal card may be used, but must not exceed 3 9-16 by 5 9-16 inches, or be smaller than 2 15-16 by 4⅝ inches. The face of the card must bear the printed words "Post Card" and the back used for written messages or for advertising purposes. Advertisements may be printed on both sides in any or all colors of ink and a one cent stamp will carry the card to any part of the United States or our island possessions.

Spon & Chamberlain, 123 Liberty street, New York City, have just issued a valuable catalogue of technical books which will interest mechanics.

Caught a Million Brook Trout

Tons of Brook Trout Caught Here

A million brook trout at one catch is a fish story hard to believe, but, nevertheless, true. The photo of this remarkable occurrence shows a scene on Kelsey creek, in Lake county, Cal., about seven miles from the little town of Lakeport.

Every spring the trout push their way up Kelsey creek from Clear Lake, crowding into the spawning grounds in such numbers that the crystal waters are often black with them. At fording places many fish are killed by passing teams.

Frequently the creeks in that section are flooded from cloudbursts back in the mountains and when the waters subside hundreds and even thousands of the fish are stranded along the banks and in the beds of the streams. A few weeks ago one of these storms occurred on Kelsey creek and the photo shows the result of the subsidence of the water. Hundreds of thousands of fish lay stranded and they were scooped up by wagon loads.

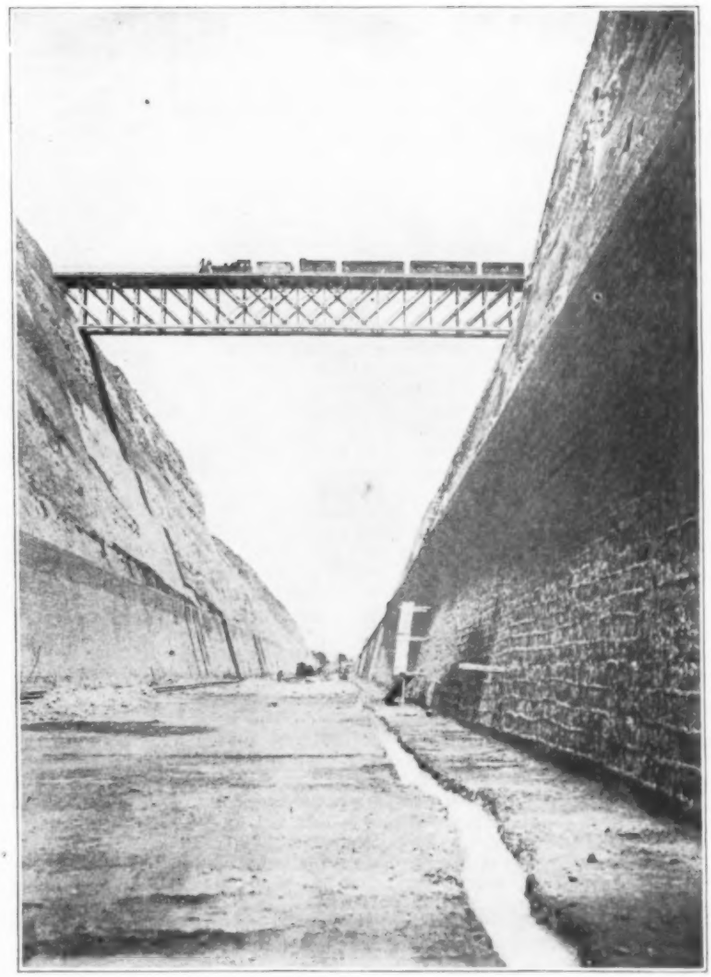
CORINTHIAN CANAL COMMENCED BY ANCIENTS NOW COMPLETED.

The Corinthian canal, commenced by ancients, has now been finished by modern engineers. It was as early as 600 B. C. that Periander, tyrant of Corinth, proposed to cut his way through the little neck of land which was all that separated his city from the other centers of Greek trade; but he was confronted by too much superstition to make his scheme feasible. Both Julius Caesar and Caligula revived the canal scheme, but neither of these Romans succeeded in effecting anything. To the Emperor Nero falls the credit of the first devisive attempt to cut through the isthmus and from evidence still to be seen the work was prosecuted with vigor, but was interrupted by his death. The resurrection of the scheme may be credited to many in later times—to the Venetians during their occupation of the Peloponnesus, to Governor Capodistria in the early days of Greek independence, to the Cretan engineer Lygouni, and especially to the Greek government itself, which in 1869 passed a law authorizing the construction of the canal. But it was not until 1881 that General Turr, aide-de-camp to King Victor Emanuel, obtained the necessary rights for beginning the work and

Looking West

organized a canal company with its seat in Paris.

The canal has cost for its final completion $11,000,000. It is four miles long and shortens the voyage between Patras and Piraeus more than 130 miles. The excavation is through the solid rock which rises abruptly to a height of 260 feet, forming a rocky canyon through which the shipping passes. At times the current and wind rush through with mighty force and vessels in the canal must tie up and wait until the storm subsides. Iron stanchions to which the ships may fasten for safety are placed at intervals of 600 feet, and at night electric lights mark the channel.



The Solid Rock Walls Tower 260 Feet

GREAT FORCE OF BROKEN EMERY WHEELS.

Experiments made at the Case School of Applied Science show that the fragments of a bursted emery wheel are often thrown with the force of a six-pound shell from a man-of-war. The tests were made by incasing the wheel in a heavy wooden box, with timbers so arranged that the force with which the fragments are thrown may be determined by indentures made on the timbers. The wheel is turned by means of a strong turbine engine. It was noticed that most of the wheels burst after the speed had reached 3,000 revolutions a minute. The students found that the wheels gave no indication beforehand that they were about to burst. The wheels usually break into quarters at right angles, as a pie is cut. When a wheel bursts at 3,000 revolutions per minute the pieces fly away from the center at a speed of 200 feet a second, which shows how great is the centrifugal force that bursts them. In machine shops the pieces of a broken wheel have been known to pass entirely through a man's body.

DON'T PATCH HEAVY BELT WITH LIGHT.

I have often seen a heavy belt patched with a piece of light belt, says a writer for the Wood Worker. When the belt is running at a low speed there is little or no trouble, but when the belt is a fast one there is trouble a-plenty. One of our machines has a finishing head that runs as fast as the main cylinder, and is driven from end of the same. The bit has a travel of over 6,000 feet a minute, consequently is a hard belt to keep up, needing frequent renewals. On the occasion of a recent break my helper put a short piece of single 3-inch belt in the double belt for a patch. It did not take long for the belt to enter an emphatic protest against being made to work with such unsuitable company. It was a good object lesson, and it is safe to say will not be tried again with that belt.

In Vienna telephone booths are furnished with napkins bearing the inscription "Wipe, if you please." The napkins are changed frequently and this undoubtedly serves to keep the mouthpieces of the transmitters in good condition.

Easy Electrical Experiments

By L. P. Dickinson

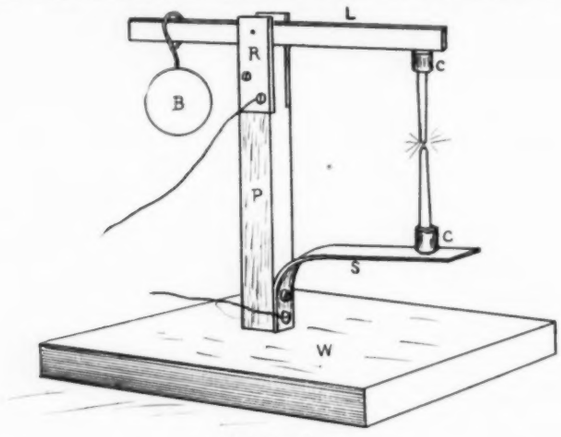
A SIMPLE ARC LAMP.

There are two kinds of electric lamps—incandescent lamps and arc lamps. The former are operated by sending a current of electricity through a very small thread of carbon contained in a glass bulb from which the air has been exhausted. The passage of the current through the carbon thread heats it very hot, so that it is capable of giving out light.

Arc lamps are operated by causing a current to pass between the tips of two carbon sticks, which are separated by a short space, usually about one-half inch in length. Ordinarily it is impossible to make an electric current pass from one body to another, unless the pressure be very great. But if two sticks of carbon connected to an electric circuit of proper strength be touched together and then separated by a short distance the space between them becomes filled with the vapor of carbon, through which the current will pass, at the same time heating the tips of the carbons to an intense white heat, which gives off a dazzling light.

As the carbons burn away it is ordinarily necessary to provide means for feeding them toward each other as fast as they are burned. This calls for a rather complicated arrangement of magnets and other devices. The amateur can construct a very simple arc lamp, however, which will illustrate the principles involved very nicely.

The arrangement of the lamp is shown in the accompanying figure. W is a wooden baseboard about 5 inches square. Near one end and on the center line of the base mount a square upright post P, 3 inches high and ½ inch square. To the upper end of this post is to be secured two flat pieces of brass shown at R, about 1 inch long, and projecting above the top of the post about ½ inch. These pieces are to form a support for a brass lever L, which is swung on a pivot which has a bearing in the strips R. This lever is 3½ inches long and the pivot is 1½ inches from the left-hand end of



The Arc Lamp

the lever. It may be made from a piece of sheet brass 1-16 inch thick and ¼ inch wide.

In order to support the carbons there will be needed two small brass sockets shown at C. These are made by taking a piece of very thin brass and curling it up into the form of a very short tube ⅜ inch long and ¼ inch in diameter.

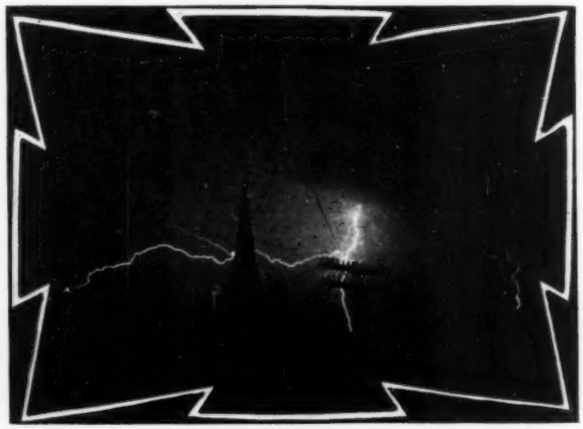
At S is a piece of brass 1/16 inch thick, bent into the shape shown, and secured to the post at the bottom, so that the outer end of the spring projects 2 inches from the post.

Near the outer end of the lever L and the spring S solder one of the little brass sockets just described. They should be equal distances from the post P when the lever L is horizontal.

Make a small lead weight, preferably in the form of a ball, as shown at B, provided with a hook so that it may be hung on the outer end of the horizontal lever. The lever should be so nicely pivoted that it swings very freely up and down. Take a piece of ordinary electric light carbon such as may be picked up in the street and break off two pieces about 1½ inches long. Put these pieces in a vise and file them down until they are each about ⅛ inch in diameter. Then insert them in the two sockets and the arc lamp is complete. The weight B should be so adjusted that it almost balances the weight of the carbons and lever, but not quite. to come together when left to itself. Connection is made by wires running to R and S. A suitable battery for use with this lamp will be described in the next paper.

REMARKABLE PHOTOGRAPH OF LIGHTNING.

Taking photographs of flashes of lightning is one of the delights of expert photographers. One of our readers, Dr. Edward A. Smith, of Madison, Wis., who takes pictures for recreation, sends one of the best specimens we have ever seen. The fork of the flash is both long and clear and the



Photograph by Lightning.

church spire against the light makes a very fine effect. Our readers will note the insulator pins on the telegraph pole, which in the photograph are so clear as to be easily counted.

Dr. Smith says: "I see in your last issue a cut of a lightning picture taken by a gentleman in Canada. I enclose you a picture somewhat similar, taken by myself about a month ago, during a severe storm.

"I think it will bear favorable comparison with our Canadian brother's picture."

MILK SHOULD BE COOLED.

Milk should be cooled as soon as possible after it is drawn. The sooner it is cooled and the lower the temperature to which it is taken the longer it will remain sweet and in good condition, according to a bulletin issued by the Illinois university. The milk may be cooled by setting the cans into a tank of cold water and stirring occasionally, or by passing the milk over a cooler. The latter method is preferred if the air surrounding can be kept free from dust. Bacteria that get into milk during the process of milking develop very rapidly so long as the milk remains at the temperature at which it was drawn, but as soon as cooled to 60 degrees F. they develop slowly and at 40 degrees their action is almost entirely stopped.

SUBMARINE BOATS A SUCCESS.

Three new Holland submarine boats, the Adder, Moccasin and Shark, recently accepted by the United States government, made great showings at their final trials. Each fired a torpedo, while under water, at a shore mark, hitting it in each case with great precision. The Moccasin proved to be the fastest of the submarine boats yet tried. She attained a speed of 8½ knots an hour, exceeding the contract speed of 8 knots. The Moccasin's shot at a shore mark was taken when she was going at half speed and at a distance of 800 yards.

INVENTOR OF THE WORLD'S DEADLIEST GUN HATED WAR.

How the Late Dr. Gatling Gained Fame and Wealth Through His Wonderful Device

Dr. Richard Jordan Gatling, inventor of the Gatling gun, who died at New York, Feb. 26, was one of the strongest opponents of war in the world. He claimed that less actual harm was done by his gun than by the old instruments and he would relate anecdotes of how the presence of the Gatling had often saved life and prevented fighting by the very moral force which its frightful destructiveness exerted on the minds of men.

Dr. Gatling was a poor man, until the idea of the gun, that was destined to bring him wealth and fame, occurred to him in 1861. He completed 13 of the machines and the ammunition for their operation. Giving them to an agent he instructed the man to go to Washington and lay them before the war department. General Ripley, then chief of the bureau of ordnance, was so conservative, however, that he positively refused even to look at the guns, saying that the old-style musket was the best conceivable kind of weapon. The agent left Washington in disgust, and, going to Baltimore, fortunately met General Benjamin F. Butler, to whom he showed the guns and related his experience at the capital. General Butler, delighted with the frightful destructiveness of the machines, asked the agent what he would take for the lot.

"I will take just $1,000 each," replied the Gatling man.

"Done!" said the general, who purchased the lot outright on behalf of the government.

General Butler took the guns South and greatly annoyed the confederates during the first engagement in which the implements were used.

Discredited at home, Dr. Gatling went abroad in 1867 and showed the gun to Napoleon III., who fired it with his own hands. The Emperor of Austria saw it and was highly pleased with it. Engran out Dr. Gatling had cleared $100,000 in royalties from the English factory. Of late years Dr. Gatling had been experimenting with smokeless powder.

The Gatling gun is now used by armies and navies everywhere. Its most recent test of note was that made in the Santiago de Cuba campaign, where it did more harm to the enemy than the great land adopted it, and before his patents dynamite gun of which so many boasts had been made, and which turned out to be not so very destructive after all.

ATLANTIC CITY IN NEW DRESS.

Gay Watering Place at Season's Opening Reveals Many New Charms

The bathing beach at Atlantic City, N. J., was opened last week. From early in the afternoon until late at night the beach swarmed with the largest crowd ever seen at the opening day of the famous resort. Many improvements in the hotel facilities and amusements resorts have beeen made since last year and gay Atlantic City is gayer than ever before. Haddon Hall glows with a coating of silica graphite paint, new walks have been laid along the beach and in fact the famous watering place looks like she has on a brand new dress throughout.

FRENCH TORPEDO BOATS SHOW MERIT

Recent trials of French submarine boats have again demonstrated their effectiveness as harbor defenders. In making an attack one of these boats repeatedly deceived the "enemy" by letting loose bottles, which were mistaken for the "periscope" of the "submersible" and finally a blank torpedo was fired, striking the ship upon which the attack was being made.

Five thousand people, in addition to those available at hand, are now needed in the canneries and orchards of California.

HOW TO MAKE A CHEAP ICE BOX.

The ice box here shown has the advantage of cheapness, as it can be made by an ordinary carpenter for ten or twelve dollars and saves fifty per cent or more in ice. Although the size here shown is suitable for kitchens of moderate size, any size box may be made by carefully keeping the proportions. This box meausures as follows: Outside length, 44 inches; outside width, 24½ inches; outside height, 29 inches; inside length, 33 inches; inside width, 14½ inches; inside depth, 20½ inches. The lid is 1½ inches in the center and 1 inch on the edge.

As will be seen from the length and breadth measurements the walls of the box are five inches thick, the inside spaces of which should be lined with building paper, solidly packed with cedar sawdust and then well sealed.

The lid should project about 1 inch at the front to facilitate opening and the entire inside of the box and top of lid should be lined with zinc. The sides of the box most exposed to the heat from the range should be well covered with sheet zinc. The bottom of the chamber should pitch a half inch from one end to the other and from the sides to the center, the drain being at the lowest level. A strip of iron about ⅛-inch thick, 1½ inches wide and 32 inches long should be screwed to one corner of the lid, allowing it to play freely, so as to act as a support for the lid when raised.

Within the box may be fitted seven heavy tin boxes 6 inches deep, 6½ inches wide and 8 inches long, with wire edges, which will be found very convenient to

Ice Box

hold steaks, chops, ham, bacon, eggs and other things, with space enough remaining for other uses. The Hotel World, from which the description is extracted, says the box is specially adapted to use in kitchens or warm rooms.

A Wisconsin concern are about to begin the manufacture of burial caskets from straw.

Germany has prohibited the use of phosphorus matches.

SHOP NOTES

FOUNDRY LADLE CARS.

Every day man is devising some new plan to save his muscles, and not only to save strength, but life as well. In foundry work the handling of the molten metal from the furnace to the mould is always attended with danger, in proportion to the amount of hot metal. For large castings there must necessarily be large ladles, and a single misstep on the part of any one of the many men required to handle them may mean loss of sight or life. The C. W. Hunt Company have built ladles on small cars which run on tracks through the foundry and which makes the pouring of liquid iron as safe as so much water.

Drawing Metal from the Furnace

The metal is drawn from the furnace into the ladle car and repoured into hand ladles which in turn are poured into the mould by two men.

The height of the top of the ladle above the rails is only thirty-six inches for a ladle of 1,500 pounds capacity, and thirty-eight inches for both 2,000 pound and 3,000 pound ladles.

Repouring into Hand Ladles

FORMULA FOR POWER NECESSARY TO ELEVATE WATER.

The horse power necessary to elevate water to a given height, says Electrical Review, is found by multiplying the total weight of the water in pounds by the height in feet, and divide the product by 33,000. An allowance of twenty-five per cent should be made for friction in pipe line.

CONCERNING RIVET HEADS.

It is not uncommon, even in these days of improved methods and presumably ideas, to find boilers held together by rivets whose heads are far too thin and flat. Some examples of this, taken from actual specimens found by inspection, are presented in the cut. The Locomotive says: "It is true that most of the rivets used in boiler work are subjected chiefly to shearing stress, but the endwise tensile stress that is always present in a good rivet, well driven, is by no means inconsiderable; and since it is this tensile stress that holds the plates together and prevents leakage, attention should be paid to the rivet-heads, upon whose strength and continuted good condition the tightness of the joint depends. The thin, fin-like edges that such rivet-heads too often present are liable to burn off, or at least to have their strength destroyed or greatly impaired by exposure to the hot furnace gases, and leakage and corrosion are the probable results. Moreover, the stresses in a boiler shell are not, in practice, nearly so simple as they are assumed to be, for the sake of convenience, in theory. We make certain assumptions concerning them, in our calculations.

Defective Rivet-Heads.

The ideal rivet is one which has the same strength at both ends; and equal strength can be secured, most certainly, by making the two heads alike, both in shape and in size. There is no necessity of having them alike in shape, however, provided the equality of strength is secured in some other maner."

HINTS TO INVENTORS.

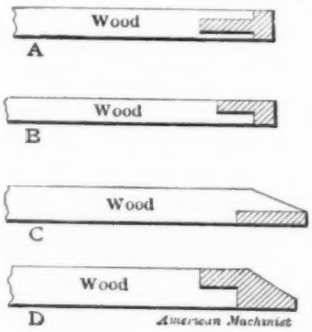
It is claimed that from 50 to 60 per cent of the heat value of oil as fuel is wasted even by the best burners known Certain it is there is a big loss and the perfect burner has not yet appeared. From 3½ to 4½ barrels of oil are now burned to equal one ton of coal. Two barrels should be the equivalent.

Count de la Vaulx, who tried to cross the Mediterranean Sea in a balloon and failed owing to bad weather, is reconstructing his balloon and will make the trial again this year. His ballast will be in the form of water pumped up through a hose the lower end of which trails in the sea. When the balloon rises more water is pumped up and when it descends some is let out.

A scheme for an electric railway system through the southern and eastern townships of Quebec has taken definite form. Two main lines will be commenced this season, one between Montreal and St. John, the other between Montreal and Valleyfield. The cars will be equipped to attain a speed of 50 or 60 miles an hour over a roadbed constructed of the most modern type of heavy rails.

CEMENTS FOR CELLULOID.

An English correspondent of the American Machinist tells how to cement celluloid to wood. The following cements which I have used have given good results. The first known as xylonite solution, is composed of shreds of celluloid dissolved with ether, and can be obtained from the British Xylonite Works, Hale End, Chingford, England. It can be used for sticking celluloid to wood, also two pieces of celluloid together, so



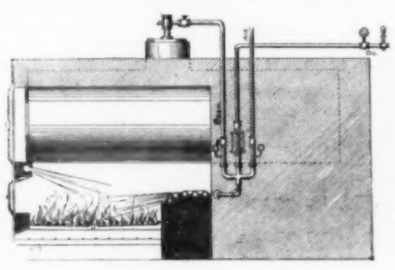
JOINTING CELLULOID TO WOOD.

that if properly cemented, it is not possible to part them. Great care must be taken that the surfaces or edges have no greasy substances on them; and, to insure against this, it will be best to thoroughly clean them with a piece of glass paper before painting the solution on. A camel's-hair brush will be most suitable for this purpose. After the solution has been applied, the pieces must be firmly clamped together and remain until thoroughly set. This solution must be kept from the air, as the ether evaporates and the solution dries up.

The second cement is called seccotine, and this will stick anything, such as wood, iron, delft, paper, pasteboard, cork, leather, felt, cloth, glass, ivory, ebony, vulcanite, bone, celluloid, etc., and it can be obtained from the manufacturers, McCaw, Stevenson & Orr, Linenhall Works, Belfast, Ireland. I have used this for cementing felt and pasteboard, celluloid and wood, vulcanite and wood, and various other substances. The directions will be the same as for the first, only where possible the articles can be slightly warmed.

COMBINED COAL AND OIL BURNER.

A plan for burning oil in combination with coal has been suggested by a New York concern and the cut shows the method employed. Heated air is supplied under the grate bars and also just above the fire door. The plan is to start the fire with coal and when the chamber is heated turn on the oil which produces a gas that burns with great intensity. It is claimed that with only a small amount of oil the coal is cut down one-half.



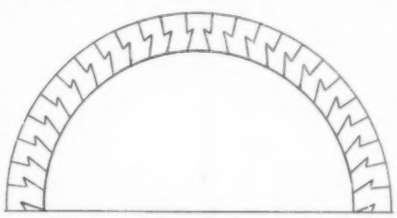
Coal and Oil Burner

"BURNING" WITH BRASS.

A writer in the Foundry, who has had considerable experience in such matters, says that defective iron castings can be more easily repaired by "burning" with brass than with iron. Less metal is required and the results average better. As an illustration, he quotes a cylinder that was nearly machined when a hole was discovered in the barrel near one of the ports. It was located so that it could not be plugged and to burn it was considered a big risk, besides there was not room enough inside the casting to hold sufficient iron to burn it. The cylinder was repaired quite successfully by burning the hole with brass. The metal used was composed of copper 16 parts, yellow metal 6 parts, lead 3 parts and tin 1 part. For burning iron it should be "jumping" hot. The metal is very fluid, searching, soft and easily machined, and is malleable when cold, so that it may be caulked.

A NEW ARCH BRICK.

A new arch brick, suitable for the building of arches for oblong kilns, either opened or muffled, is described and illustrated in a recent issue of the British Clayworker. Reference to our illustration will show that a check is worked in each brick which fits into its neighboring brick, and so on all along the arch, with the exception of the central



AN ENGLISH ARCH BRICK OF NOVEL DESIGN.

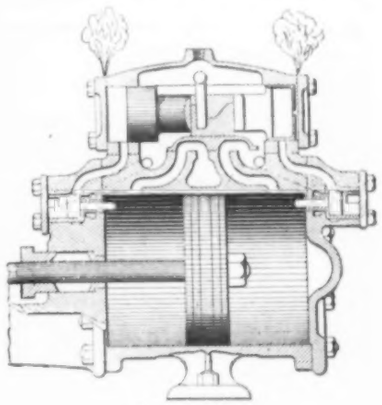
brick, which has a special check. When these bricks have been fitted together increased pressure only makes the arch the more compact. A great advantage to our mind, says Brick, seems to be that in the expansion and contraction of the bricks during firing and cooling of the kiln it is impossible for them to get loose and tumble down, as is the case with ordinary wedge brick. The behaviour of these bricks under great heat so far has been all that could be desired.

TO LOOK FOR M'GINTY.

Signor Guiseppe Pini, an Italian, has invented an instrument by which, it is claimed, it is possible to so illuminate the sea that the bottom is plainly visible at great depths. The device is called a hydroscope and by its help the captain may stand on his bridge and see the rocks, sandbars, derelict, cables, marine monsters, sunken treasure, torpedoes and even the bottom of his own ship. The discovery of old treasures of gold, gems and art are made easy and the coast defense torpedo and submarine mine lose their jobs.

TEMPORARY CURE OF PUMP.

I was once called to an isolated plant to see what was the matter with the water supply pump which had just come from the repair shop, says a writer in Power. Upon examination, I found that the auxiliary valve had not been repaired and was leaking badly (Cameron pump), which prevented its working. I told the engineer what was the matter and that it would be necessary to take



Curing Pump

the steam chest back to the shop and bore it and make a new valve. Then he told me his supply tank was almost empty and wanted to know if I could fix it any way to pump enough water to run him the next day. I studied for a while and finally hit upon a plan. Taking the two heads off the steam chest, I turned the steam, noting the amount that leaked through each end; then, after removing the gaskets, putting the heads back and screwing the bolts just tight enough to allow the same amount of steam to escape, the pump immediately went to work.

MOULDING SAND — MELTING SMALL HEATS OF IRON OR BRASS.

Moulding sand can be made by mixing from 10 to 14 per cent of clay with 90 to 86 per cent silica sand. The sand should be fine enough to have a velvety feeling when rubbed in the hand. Small quantities of iron or brass, says John L. Bacon in the American Blacksmith, can be melted in a crucible in an ordinary forge. These crucibles should be kept covered to prevent the air from reacting on the melted metal. When melting brass it is a good plan to throw charcoal on top of the metal when it melts. When making brass castings, melt the copper first and then add the necessary amount of zinc, etc. The zinc would be burned out of the mixture before the copper melted if the scraps of the different metals were put in at the same time. If the pattern is made of white pine, the weight of the casting will be sixteen times the weight of the patern, if the casting is made of cast-iron, and nineteen times the weight of the patern if made of brass.

Dr. Samuel A. Matthews of the University of Chicago announces that he has discovered a cure for lockjaw, locomotor ataxia, uremia and morphine poison. A solution of calcium chloride, sodium sulphate and sodium citrate is injected, in large quantities, into the veins of the patient.

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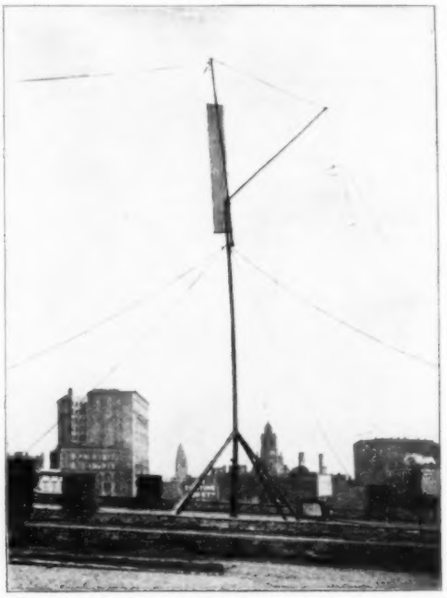
WIRELESS TELEGRAPH LINE IN DETROIT.

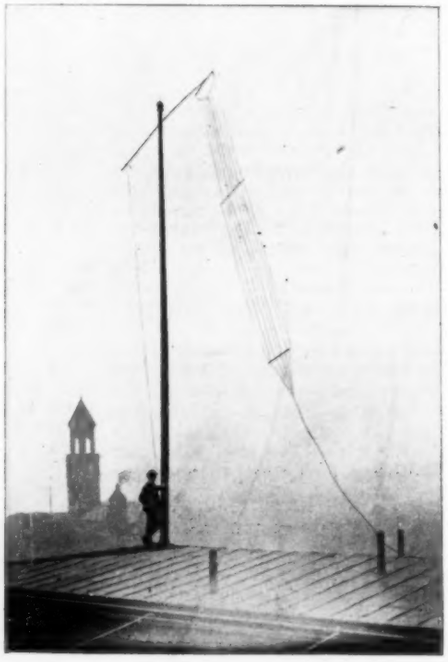
Wireless telegraph lines are being used in Detroit for communication between points several miles apart. The illustrations show the method employed by the Clark system, whose instruments are made in that city. The stations in the business part of town are on the tops of high buildings.



Mast on Michigan Avenue

wires leading down from the poles to the receiving instruments, which may be placed in any room desired.

Another illustration shows a receiving and sending instrument used for transmitting messages two to eight miles, the distance of transmission in any case being dependent upon the battery power behind the instrument. This outfit,



Mast Above Chamber of Commerce

as shown, consists of a Clark sending coil, microphonic responder, telephonic receiver, batteries, retardation coils, etc. It is a completely equipped station, save for the antenna and the coil batteries.

The messages are received in the shape of sharp clicks.

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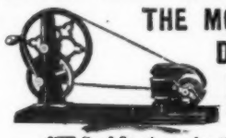

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A DOG CHAIN CIRCUIT.

An "interruption man" in the East India telegraph service has a harrowing time of it. Monkeys "monkey" with the wire and carrion birds drop entrails over them. Elephants scratch themselves once on a post and then there has to be a new post put in. One interruption man found after putting up several hundred miles of wire that he lacked about four feet to finish the circuit, pull as hard as he could it was impossible to stretch the wire any more. Then a bright yankee idea struck him says, the Engineering Times. He took his dog's chain and completed the line amid cheers of the natives and to the great relief of himself and associates.

WHAT TO DO WHEN YOUR AUTO SLIDES.

The principal cause of side slip is driving a car too fast over slippery road and when turning corners, and therefore its best means of prevention is to always drive very slowly and carefully, manipulating the steering wheel slightly to give a grip to the front wheels, says the Automobile Review. If the car begins to slip, stop it without applying the brakes, but by shutting off the power, because if the wheels are locked by brakes the machine is almost certain to slide clear around. If the brakes are used at all it must be very gently indeed. An experienced driver can feel the car getting ready to skid, almost before it happens, and slow down; but an ignorant or careless person is most likely to aggravate the trouble.

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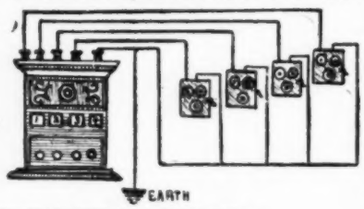

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Who has not known the irony
Of fate?

We enter it when we are born,
Our colors bright. Full soon they fade.
We exit "done up" old and worn
And frayed;

Frayed round the edges, worn and thin—
Life is a rough old linen-slinger,
Who has not lost a button in
Life's wringer?

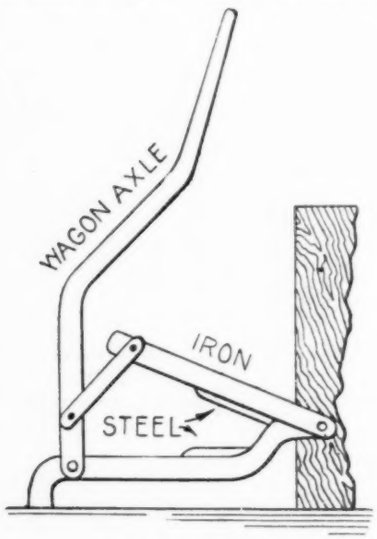
With other linen we are tubbed,
With other linen often tangled;
In open court we then are scrubbed
And mangled.

Some take a gloss of happiness
The hardest wear cannot diminish;
Others, alas! get a "domestic finish."

—Chicago Tribune.

HOME MADE SHEARS.

The figure accompanying this represents a pair of iron cutters which I have made, says a contributor in the American Blacksmith. It took me about a half a day to make them, and I can recommend the same to my brother craftsmen as



Home Made Shears

doing fine work. They only cost me about fifty cents to make. The upper movable jaw is of iron, 1x2x18 inches. The cutters are made of ½x1-inch tool steel, six inches long. The link connecting the handle with the upper jaw is nine inches long, made of 1x⅜ stock.

According to a technical paper very good "lemonade" can be made from sea water by the use of citric acid, which precipitates the salt, the remainder being harmless mineral water. Seven ounces of citric acid will supply one man with marine lemonade for one week. Persons about to be shipwrecked should provide themselves with this prescription.

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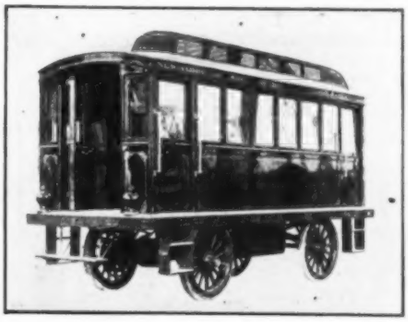

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On both sides of the vehicle are wooden compartments or "pockets" closely resembling the pigeon holes of a railway mail car used in sorting letters. These pockets are filled with railroad and steamship folders and it does not require an over-active mind to see the relation of this novel vehicle to the time table racks in the offices, which in New York City alone required last year 5,000,000 folders, averaging 1½ tons a day.

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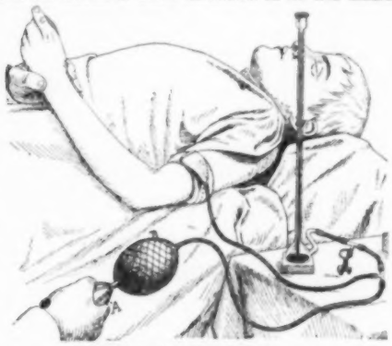

Testing the Blood Pressure

with which he creates an air pressure in the bulb B. By changing the air pressure a reading is secured on the glass tube, which gives the desired information.

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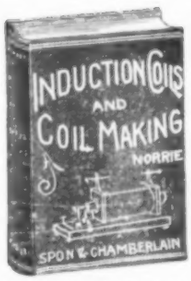

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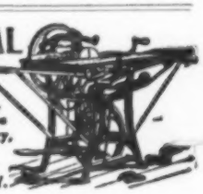

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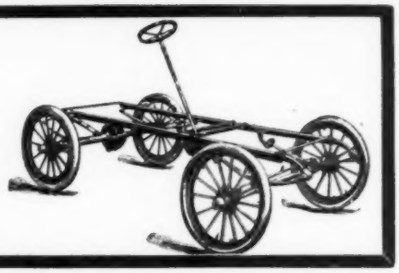
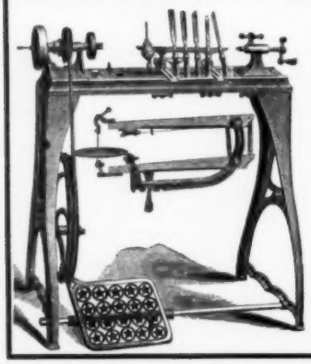


Combination WOOD LATHE and SCROLL SAW



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